

Uncertainties in Aspheric Profile Measurements with the Geometry Measuring Machine at NIST

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The Geometry Measuring Machine (GEMM) at the National Institute of Standards and Technology (NIST) is a profilometer for free-form surfaces. It measures the local curvature of a test part surface at several locations along a line. The profile is then reconstructed from the curvature data. For form measurements of free-form surfaces, methods based on local part curvature sensing have strong appeal. Unlike full-aperture interferometry they do not require customized null optics. The uncertainty of the reconstructed profile is critically dependent on the curvature measurement uncertainty. We evaluate the measurement uncertainties for a curvature sensor based on a small aperture interferometer and the resulting uncertainty for the reconstructed profile. Profile measurements of a free-form mirror made with GEMM are compared with measurements using a long-trace profiler and subaperture-stitching interferometry.